

PRELIMINARY DATA SUMMARY

February 1988

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

PRELIMINARY DATA SUMMARY

CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Field Research Facility Measurement and Analysis Work Unit at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility (FRF) in Duck, North Carolina. The FRF staff collected and analyzed these data. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

CONTENTS

	<u>Page</u>
TABLE OF CONTENTS.....	1
PART I: INTRODUCTION.....	2
PART II: METEOROLOGICAL DATA.....	6
PART III: WAVE DATA.....	9
PART IV: CURRENT DATA.....	13
PART V: SUPPLEMENTAL OBSERVATIONS.....	20
PART VI: WATER LEVELS.....	22
PART VII: NEARSHORE PROFILES AND BATHYMETRY.....	25
PART VIII: SPECIAL EVENTS.....	28

LIST OF FIGURES

<u>No.</u>		<u>Page</u>
1	Location map.....	3
2	Instrument locations.....	5
3	Time history of wave heights and periods.....	12
4	Water level time history.....	23
5	CRAB profiles.....	25
6	CRAB profile envelope.....	26
7	FRF contour diagram.....	27

LIST OF TABLES

<u>No.</u>		<u>Page</u>
1	Instrument Status/Data Availability.....	4
2	Meteorological Data.....	7
3	Wave Data.....	10
4	Current Data.....	14
5	Supplemental Observations.....	21
6	Tidal Characteristics.....	24

PART I: INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC's) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Figure 1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The pier deck is 6.1 m wide and extends from behind the duneline to about the 6-m water depth contour at a height 7.6 m above the National Geodetic Vertical Datum (NGVD). In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Questions and/or comments concerning the data may be directed to Mr. Herman C. Miller at (919) 261-3511.

Part II presents the meteorological data; Parts III through VI present oceanographic data; Part VII presents nearshore profiles and bathymetry; and Part VIII, if included, documents special events that occurred at the FRF during the month.

Table 1 is a list of instruments used, their operational status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depths at the wave gages and current meters vary and may be determined from information contained in Figure 7. Other installation information is contained in Table 1.

Times given in the report, unless otherwise specified, are referenced to eastern standard time (EST).

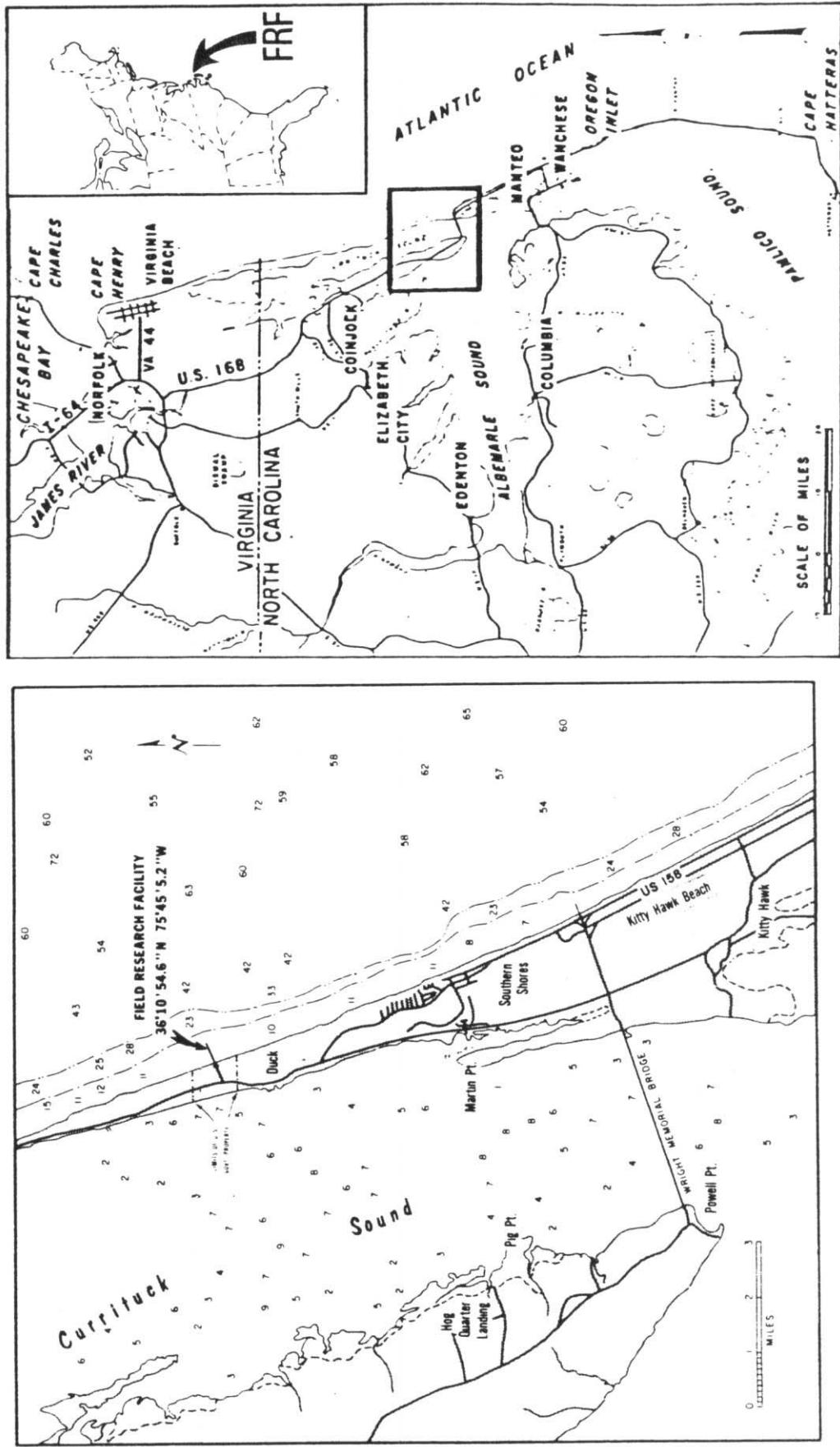


Figure 1. FRF location map

Table 1: Instrument Status/Data Availability

FEB 1988

Gage ID	Description/Remarks	Depth at Sensor	Day of the month																												
			1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
616	Barometric Pressure		Gage Status Data Collected Analog Record	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
604	Precipitation		Gage Status Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
624	Air Temperature		Gage Status Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
632	Anemometer on Laboratory Building Elevation 19 m (NGVD)		Gage Status Data Collected Analog Record	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
645	Baylor staff at station 7+80 on FRF pier	see Figure 7	Gage Status Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
625	Baylor staff at station 19+00 on FRF pier	see Figure 7	Gage Status Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
111	Pressure gage 309 m north of FRF pier (0.9 km offshore)	Approx. 7.8 m NGVD	Gage Status Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
630	Waverider buoy 6.0 km offshore	Approx. 23 m NGVD	Gage Status Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
679	Current meter 500 m south of FRF pier (0.5 km offshore)	see Figure 7	Gage Status Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
865-1370	NOAA tide station at seaward end of FRF pier		Gage Status Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	-	-	*	*				
	Supplemental Observations (daily oceanographic and meteorological observations)		Daily observation	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	

Gage Status	Daily Observation	Analog Record	Data Collected
Operational = *	Complete = *	Complete = *	All = *
Partial = /	Partial = /	Partial = /	Partial = /
Non-Operational = -	None = -	None = -	None = -

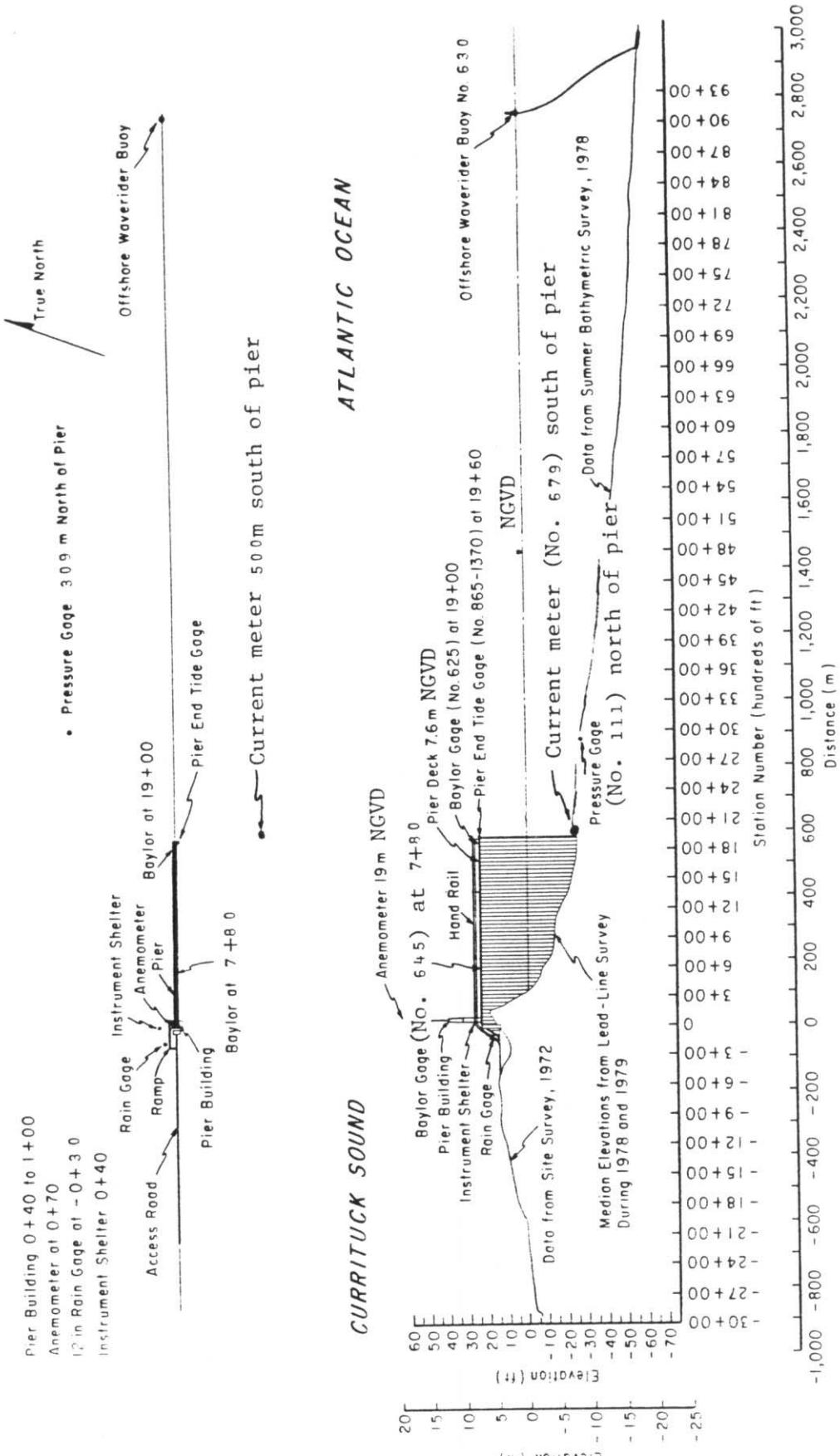


Figure 2. Instrument locations at FRF

PART II: METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Figure 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

Winds were measured on top of the laboratory building at an elevation of 19 m (Figure 2) using a Weather Measure Skyvane anemometer.

Monthly resultant wind speeds and directions are determined by vector averaging the data. Temperature and atmospheric means are the average of the values presented for the month. Total precipitation is the sum for the month.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in) -
 $mm \times .03937 = in$
2. Millibars (mb) to inches of mercury (in Hg) -
 $mb \times 0.02953 = in Hg$
3. Degrees Celsius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $m/s \times 1.943 = kn$

TABLE 2: Meteorological Data

FEB 1988

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
1	100	5	96	11.7	1028.7	0
	700	2	79	11.1	1029.1	0
	1300	4	85	20.0	1027.4	0
	1900	6	85	15.4	1026.0	0
2	100	4	93	14.1	1025.7	0
	700	5	1	13.6	1025.0	0
	1300	8	2	19.2	1020.9	0
	1900	8	1	16.3	1019.6	0
3	100	9	42	8.0	1019.6	5
	700	12	13	6.7	1024.0	7
	1300	10	8	7.1	1025.7	0
	1900	8	6	7.1	1025.3	0
4	100	3	83	7.6	1020.6	0
	700	3	99	9.3	1014.5	0
	1300	7	51	10.0	1010.8	2
	1900	11	49	6.2	1015.5	0
5	100	9	33	1.8	1020.9	0
	700	7	59	1.3	1024.3	0
	1300	3	47	2.7	1024.0	0
	1900	2	72	2.1	1024.3	0
6	100	8	93	2.8	1023.6	0
	700	13	4	-1.9	1027.0	0
	1300	9	44	-2.9	1028.4	0
	1900	4	20	-3.4	1029.4	0
7	100	6	11	-4.2	1032.4	0
	700	8	55	-5.0	1036.8	0
	1300	2	32	-3.2	1036.2	0
	1900	3	67	-3.8	1033.5	0
8	100	4	21	-0.1	1030.4	0
	700	2	21	0.8	1029.1	0
	1300	1	18	7.4	1027.0	0
	1900	5	42	4.0	1026.7	0
9	100	4	25	5.0	1023.6	0
	700	7	45	5.8	1025.0	0
	1300	5	20	6.9	1023.6	0
	1900	6	36	5.9	1023.0	0
10	100	5	54	5.8	1021.3	0
	700	7	11	5.6	1023.3	0
	1300	10	2	6.6	1026.0	0
	1900	7	45	5.6	1027.4	0
11	100	8	36	5.9	1026.7	0
	700	9	37	6.4	1026.0	0
	1300	10	66	8.1	1021.6	0
	1900	7	26	8.6	1017.5	0
12	100	6	63	14.8	1010.8	12
	700	6	77	7.7	1006.7	13
	1300	4	36	6.6	1003.7	0
	1900	9	61	4.8	1004.0	0
13	100	12	71	-1.3	1009.1	0
	700	12	69	-3.9	1012.5	0
	1300	11	61	-1.1	1012.1	0
	1900	11	56	0.0	1015.2	0
14	100	9	81	-1.4	1020.3	0
	700	5	96	-3.1	1024.7	0
	1300	3	88	3.3	1024.3	0
	1900	5	58	0.8	1023.6	0
15	100	5	52	4.5	1020.3	0
	700	5	39	7.2	1017.5	0
	1300	10	68	16.6	1010.1	0
	1900	5	79	14.1	1005.4	10
16	100	3	81	12.3	999.6	8
	700	8	29	8.8	1003.7	0
	1300	6	32	8.2	1012.1	0
	1900	3	98	5.5	1017.9	0

(Continued)

(Sheet 1 of 2)

TABLE 2: Meteorological Data

FEB 1988

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
17	100	4	67	3.8	1020.9	
	700	3	7	5.8	1023.3	19
	1300	2	45	11.9	1023.0	0
	1900	4	40	7.4	1021.3	0
18	100	2	70	6.4	1019.6	0
	700	3	50	6.4	1018.9	0
	1300	2	83	11.9	1018.9	0
	1900	4	60	7.8	1020.6	0
19	100	6	41	7.9	1019.2	0
	700	9	63	8.0	1015.9	0
	1300	4	63	8.7	1010.8	5
	1900	6	36	10.2	1004.0	0
20	100	5	37	12.4	1003.0	0
	700	7	41	10.9	1004.7	0
	1300	7	24	11.7	1002.6	0
	1900	8	17	12.1	1003.7	4
21	100	7	41	10.3	1005.4	0
	700	7	82	7.6	1009.4	0
	1300	9	17	4.5	1013.1	0
	1900	6	13	2.4	1019.2	0
22	100	3	91	1.7	1023.0	0
	700	4	58	1.8	1026.0	0
	1300	6	78	10.4	1024.3	0
	1900	6	84	9.9	1021.3	0
23	100	7	20	8.9	1019.6	0
	700	7	22	8.8	1019.2	0
	1300	10	5	16.3	1013.1	0
	1900	7	1	13.0	1012.8	0
24	100	5	43	7.9	1015.9	0
	700	3	2	7.0	1016.9	0
	1300	4	68	9.1	1015.5	0
	1900	7	29	3.8	1018.2	0
25	100	7	11	1.2	1019.6	0
	700	5	100	1.1	1020.9	0
	1300	2	54	3.5	1018.6	0
	1900	5	48	3.5	1018.6	0
26	100	5	53	2.2	1020.6	0
	700	6	26	0.0	1023.0	0
	1300	6	14	2.8	1021.9	0
	1900	4	37	2.0	1019.9	0
27	100	8	17	4.8	1016.2	0
	700	8	21	4.7	1011.8	0
	1300	3	6	12.5	1005.4	0
	1900	7	19	8.4	1007.0	0
28	100	10	33	4.4	1010.1	0
	700	16	8	4.9	1013.8	0
	1300	10	54	3.8	1017.2	0
	1900	4	12	3.6	1018.6	0
29	100	1	48	0.8	1018.6	0
	700	4	97	3.0	1018.6	0
	1300	4	34	10.3	1016.5	0
	1900	3	20	9.0	1016.5	0
		Resultant 6	42	Mean 6.2	Mean 1018.9	Total 85

(Sheet 2 of 2)

PART III: WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645), a pressure wave gage (Gage 111) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 6 hrs (more frequently during storms) near 0100, 0700, 1300, and 1900 EST. The sampling rate is two times per second for 34 minutes.

Wave height H_{mo} is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. Wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. Peak wave period T_p is defined as the period associated with the maximum energy in the spectrum. When this analysis is complete, the data are written to magnetic tape.

Table 3 presents the wave heights and periods for each wave record obtained at 6 hr intervals during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed from this data. Figure 3 is a time history of all H_{mo} and T_p values obtained for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

TABLE 3: WAVE DATA

FEB 1988

Day	Hour	645		625		111		630	
		Baylor at 7+80	Hmo,m T,sec	Baylor at 19+00	Hmo,m T,sec	Pressure Gage	Hmo,m T,sec	Farshr Wvrdr	Hmo,m T,sec
1	0100	0.31	12.19	0.50	8.83	0.49	9.14	0.59	10.67
	0700	0.38	5.12	0.56	10.24	0.56	10.24	0.79	5.69
	1300	0.36	12.19	0.59	9.14	0.58	9.48	0.74	5.57
	1900	0.40	13.47	0.60	13.47	0.56	12.80	0.75	6.74
2	0100	0.38	14.22	0.56	9.14	0.54	9.85	0.75	9.85
	0700	0.48	12.19	0.65	15.06	0.69	8.83	0.88	5.82
	1300	0.48	9.48	0.70	9.85	0.68	9.85	0.91	10.24
	1900	0.50	15.06	0.69	10.24	0.75	9.85	0.99	9.85
3	0100	0.46	15.06	0.67	15.06	0.66	15.06	0.88	9.85
	0700	1.61	6.24	1.95	6.74	2.12	6.56	2.35	6.40
	1300	1.08	7.31	1.69	8.26	1.77	7.53	1.88	7.53
	1900	1.27	8.53	1.61	8.00	1.78	8.00	1.80	7.53
4	0100	1.08	7.76	1.39	8.83	1.63	8.53	1.51	8.26
	0700	1.02	9.48	1.55	9.14	1.57	9.14	1.55	9.14
	1300	0.85	9.48	1.19	9.85	1.17	10.24	1.20	9.85
	1900	0.86	9.85	1.26	10.24	1.21	10.24	1.45	10.24
5	0100	1.14	6.09	1.51	6.09	1.65	6.09	2.07	5.69
	0700	1.27	6.56	1.39	6.56	1.39	5.82	1.68	6.24
	1300	0.90	5.82	1.00	9.14	1.01	10.24	1.03	10.24
	1900	0.65	6.74	0.82	9.85	0.86	8.83	0.92	9.85
6	0100	0.39	10.24	0.61	9.85	0.65	9.48	0.69	9.85
	0700	1.48	6.40	1.72	6.24	1.88	6.09	2.14	6.40
	1300	1.11	6.74	1.48	6.92	1.62	6.74	1.82	6.74
	1900	0.99	5.69	1.04	6.24	1.03	5.69	1.28	6.24
7	0100	0.93	5.33	0.88	5.69	0.93	5.45	1.00	5.45
	0700	1.28	5.95	1.36	5.95	1.40	6.09	1.72	6.09
	1300	1.05	5.45	0.94	5.95	0.96	6.09	1.07	5.82
	1900	0.73	5.12	0.73	5.69	0.79	5.57	0.78	5.69
8	0100	0.45	5.69	0.54	15.06	0.60	16.00	0.59	9.85
	0700	0.28	15.06	0.43	15.06	0.48	15.06	0.45	14.22
	1300	0.27	15.06	0.44	15.06	0.50	15.06	0.46	15.06
	1900	0.44	10.67	0.66	10.24	0.69	10.24	0.70	10.67
9	0100	0.54	12.19	0.83	11.64	0.87	11.64	0.82	11.13
	0700	0.81	11.13	1.01	11.13	0.99	11.13	1.01	10.67
	1300	0.69	10.67	0.99	11.13	1.00	11.13	1.05	11.13
	1900	0.73	11.13	0.96	11.13	0.95	11.13	1.01	10.67
10	0100	0.55	10.67	0.88	10.24	0.94	9.48	0.93	9.48
	0700	0.59	9.85	0.83	9.85	0.80	10.24	0.93	10.24
	1300	0.81	4.83	1.30	5.33	1.27	5.12	1.49	5.33
	1900	1.04	5.57	1.46	6.24	1.43	5.82	1.60	6.74
11	0100	0.88	5.22	1.30	8.53	1.40	8.26	1.52	8.00
	0700	1.03	5.02	1.60	9.48	1.61	5.45	1.72	5.95
	1300	1.14	5.95	1.70	6.56	1.75	6.24	1.93	6.40
	1900	1.09	6.40	1.50	7.31	1.51	6.92	1.68	6.56
12	0100	1.31	8.83	2.04	8.53	2.09	8.26	2.41	8.83
	0700	1.23	9.48	2.17	9.14	2.17	9.48	2.40	9.14
	1300	0.89	9.14	1.48	9.14	1.45	9.48	1.55	8.53
	1900	0.59	9.14	1.04	9.48	1.02	8.26	1.17	8.53
13	0100	0.62	9.85	0.91	9.14	0.89	10.67	1.15	8.83
	0700	0.76	5.69	0.89	10.67	0.89	9.85	1.23	10.24
	1300	0.46	11.64	0.66	10.67	0.65	9.85	0.91	10.67
	1900	0.30	11.13	0.43	12.80	0.43	11.13	0.75	2.94
14	0100	0.40	12.19	0.55	12.19	0.47	12.80	0.67	3.56
	0700	0.62	4.00	0.67	12.19	0.63	12.80	0.74	6.74
	1300	0.39	12.19	0.62	6.56	0.56	11.64	0.68	5.69
	1900	0.38	2.64	0.50	12.19	0.46	11.64	0.69	5.69
15	0100	0.24	12.19	0.38	11.13	0.40	11.64	0.45	10.67
	0700	0.20	13.47	0.32	12.80	0.33	12.19	0.34	12.19
	1300	0.69	3.71	0.69	3.46	0.73	3.46	0.85	5.57
	1900	0.65	7.53	0.76	7.76	0.88	8.00	1.15	7.53
16	0100	0.84	9.48	0.99	9.48	1.06	9.48	1.43	9.14
	0700	0.71	9.48	0.98	9.48	1.04	9.85	1.28	10.67
	1300	0.98	6.24	1.29	5.69	1.38	5.57	1.54	5.82
	1900	0.85	6.56	1.10	9.85	1.10	9.85	1.29	9.48

* Electronic problems

(Continued)

(Sheet 1 of 2)

TABLE 3: WAVE DATA

FEB 1988

Day	Hour	645		625		111		630	
		Baylor at 7+80	Hmo,m T,sec	Baylor at 19+00	Hmo,m T,sec	Pressure Gage	Hmo,m T,sec	Farshr Wvrdr	Hmo,m T,sec
17	0100	0.56	9.85	0.88	10.24	0.91	9.85	0.99	9.65
	0700	0.50	9.85	0.73	9.85	0.74	9.48	0.85	10.24
	1300	0.38	9.85	0.74	8.83	0.82	9.14	0.86	9.48
	1900	0.48	8.83	0.76	9.48	0.80	8.83	0.83	9.48
18	0100	0.28	12.19	0.62	12.19	0.71	12.19	0.73	8.26
	0700	0.38	11.64	0.61	11.64	0.66	11.13	0.67	11.13
	1300	0.23	12.19	0.51	11.13	0.56	10.67	0.61	9.14
	1900	0.35	8.53	0.56	8.83	0.63	8.26	0.63	8.53
19	0100	0.42	7.53	0.65	8.00	0.58	8.53	0.69	9.14
	0700	0.75	3.88	0.90	3.77	0.92	4.00	1.01	7.76
	1300	0.78	5.82	1.16	5.82	1.23	5.69	1.35	5.82
	1900	0.91	6.09	1.29	6.74	1.41	6.56	1.49	6.09
20	0100	0.73	7.31	1.11	7.76	1.08	6.92	1.29	7.76
	0700	0.62	6.92	0.90	7.31	0.94	7.31	1.03	6.92
	1300	0.43	7.31	0.65	7.76	0.68	7.53	0.77	7.11
	1900	0.37	8.26	0.50	8.53	0.58	8.53	0.78	8.53
21	0100	0.26	8.53	0.40	8.53	0.45	9.48	0.62	8.53
	0700	0.26	9.14	0.38	8.00	0.39	9.14	0.50	8.83
	1300	0.62	3.77	0.76	3.88	0.73	3.66	0.86	4.27
	1900	0.99	5.82	1.01	5.45	1.10	5.57	1.24	5.22
22	0100	0.72	6.09	0.81	5.95	0.86	6.09	1.01	5.82
	0700	0.45	5.33	0.58	5.33	0.55	5.69	0.69	5.45
	1300	0.34	2.84	0.47	8.83	0.38	9.48	0.62	3.24
	1900	0.33	2.94	0.39	6.56	0.36	6.56	0.53	2.64
23	0100	0.34	4.57	0.43	9.14	0.41	5.02	0.55	5.57
	0700	0.22	3.66	0.30	8.53	0.36	6.40	0.55	2.39
	1300	0.28	3.88	0.35	12.80	0.34	11.64	0.69	2.88
	1900	0.37	3.56	0.39	3.82	0.42	3.77	0.64	5.02
24	0100	0.27	4.34	0.35	4.66	0.36	6.24	0.54	4.92
	0700	0.27	3.01	0.37	6.40	0.35	12.19	0.49	5.82
	1300	0.31	4.57	0.48	4.27	0.46	4.34	0.52	4.57
	1900	0.86	4.66	0.99	4.83	1.01	4.83	1.11	4.57
25	0100	0.48	4.57	0.60	4.66	0.62	4.66	0.73	4.74
	0700	0.56	4.57	0.70	5.02	0.69	4.92	0.89	4.20
	1300	0.44	4.49	0.51	5.02	0.56	4.49	0.69	4.57
	1900	0.43	2.19	0.48	4.57	0.51	8.00	0.59	4.41
26	0100	0.30	2.88	0.42	8.26	0.38	4.83	0.53	8.26
	0700	0.67	4.27	0.78	4.41	0.78	4.57	1.24	4.57
	1300	0.73	5.02	0.83	5.12	0.90	4.92	1.07	4.92
	1900	0.51	4.83	0.54	4.74	0.58	4.83	0.65	5.12
27	0100	0.30	8.83	0.51	8.53	0.53	8.53	0.65	8.53
	0700	0.27	9.85	0.48	9.48	0.54	9.14	0.72	9.48
	1300	0.31	9.48	0.46	8.83	0.48	8.83	0.57	8.53
	1900	0.42	12.80	0.73	11.64	0.74	12.19	0.78	11.13
28	0100	1.29	5.45	1.69	12.80	1.78	5.22	2.01	5.45
	0700	1.66	6.40	2.32	12.19	2.60	12.19	2.74	5.82
	1300	1.35	8.00	2.46	9.48	2.76	9.48	2.63	9.48
	1900	1.65	12.19	2.29	12.19	2.50	12.19	2.18	12.19
29	0100	1.56	12.19	2.12	11.64	2.23	11.64	1.81	11.64
	0700	1.08	12.19	1.79	11.64	2.07	11.64	1.76	11.13
	1300	1.07	12.19	1.69	11.64	1.66	11.64	1.51	11.64
	1900	0.71	11.13	1.39	11.13	1.46	11.64	1.32	11.64
Mean		0.68	8.01	0.93	8.80	0.97	8.64	1.09	7.78
Std dev		0.36	3.28	0.50	2.79	0.54	2.79	0.53	2.59

* Electronic problems

(Sheet 2 of 2)

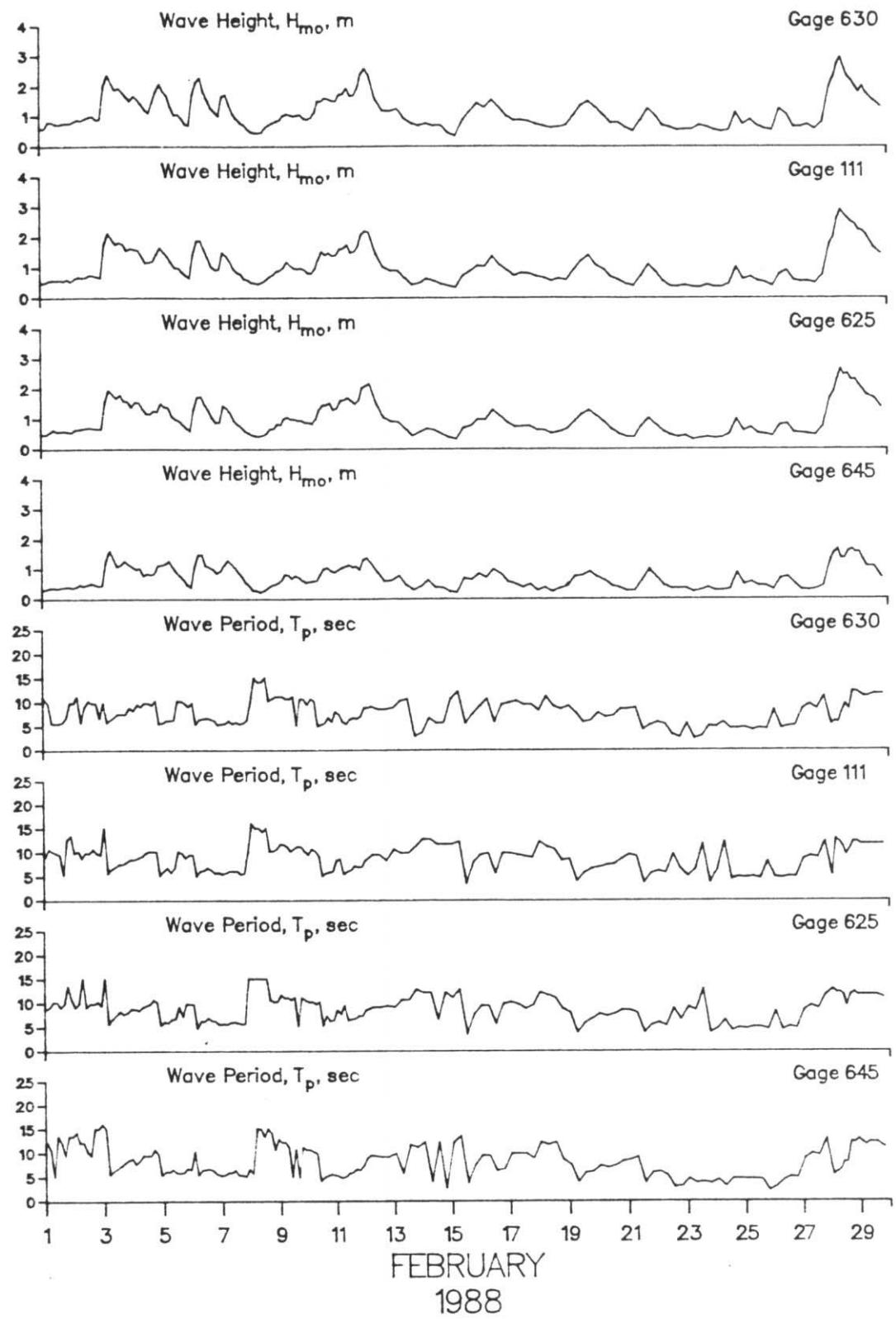


Figure 3. Time history of wave heights and periods

PART IV: CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, longshore currents flow either toward 340 deg (i.e. northward) or toward 160 deg (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second (cm/sec). Resultant speeds and directions are determined by vector averaging the data.

TABLE 4: Current Data
FEB 1988

Alongshore Cross-shore Resultant Time Day	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
	Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir
1 0100-Along Cross Result										10	N
										4	on
										11	318
1 0700-Along Cross Result	15 7 16	N off 7		41 6 41	N off 349			26	N	6	N
								South		3	on
										7	313
1 1300-Along Cross Result										6	N
										3	on
										7	313
1 1900-Along Cross Result										7	N
										2	on
										7	324
2 0100-Along Cross Result										4	N
										4	on
										6	295
2 0700-Along Cross Result	29 9 30	N off 357		38 2 38	N off 343			26	S	9	N
								North		3	on
										9	322
2 1300-Along Cross Result										15	N
										5	on
										16	322
2 1900-Along Cross Result										13	N
										5	on
										14	319
3 0100-Along Cross Result										3	N
										2	on
										4	306
3 0700-Along Cross Result	55 3 55	S on 163		10 2 10	S on 171			119	S	35	S
								North		3	off
										35	155
3 1300-Along Cross Result										31	S
										3	off
										31	154
3 1900-Along Cross Result										28	S
										0	
										28	160
4 0100-Along Cross Result										22	S
										1	on
										22	163
4 0700-Along Cross Result	6 2 7	S off 143		34 12 36	N off 359			49	S	13	S
								South		2	on
										13	169
4 1300-Along Cross Result										13	S
										1	on
										13	164
4 1900-Along Cross Result										40	S
										5	off
										40	153
5 0100-Along Cross Result										37	S
										3	off
										37	155
5 0700-Along Cross Result	38 2 38	S on 163		61 18 64	S on 177			61	S	23	S
								North		4	off
										23	150
5 1300-Along Cross Result										11	S
										2	on
										11	170
5 1900-Along Cross Result										2	N
										3	on
										4	284

KEY = All speeds in CM/SEC
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

TABLE 4: Current Data
FEB 1988

Day	Pier Measurements						Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679	
	Alongshore Cross-shore Resultant Time	Dye at (579 m) (surface) Speed	Dye at (579 m) (surface) Dir	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed	Dir
6 0100-Along Cross Result										6	N
										4	on
										7	306
6 0700-Along Cross Result	76 0	S 160		152	122 0	S 160		133 S		32	S
							North			3	off
										32	155
6 1300-Along Cross Result										31	S
										4	off
										31	153
6 1900-Along Cross Result										10	S
										5	off
										11	133
7 0100-Along Cross Result										11	S
										2	off
										11	150
7 0700-Along Cross Result	38 0	S 160		152	87 0	S 160		90 S		27	S
							North			2	off
										27	156
7 1300-Along Cross Result										16	S
										1	off
										16	156
7 1900-Along Cross Result										7	S
										1	off
										7	152
8 0100-Along Cross Result										2	N
										2	on
										3	295
8 0700-Along Cross Result	20 6	N off		140	21 3	N off		8 S		11	N
							South			3	on
										11	325
8 1300-Along Cross Result	21	357			21	349				7	N
										2	on
										7	324
8 1900-Along Cross Result										0	
										0	
										0	
9 0100-Along Cross Result										9	S
										3	off
										9	142
9 0700-Along Cross Result	15 3	S on		152	23 10	S on		37 S		7	S
							North			2	off
										7	144
9 1300-Along Cross Result	15	171			25	184				13	S
										3	off
										13	147
9 1900-Along Cross Result										10	S
										1	off
										10	154
10 0100-Along Cross Result										14	S
										3	off
										14	148
10 0700-Along Cross Result	36 7	S on		152	41 8	S off		6 N		12	S
							North			2	off
										12	151
10 1300-Along Cross Result	37	171			41	149				25	S
										3	off
										25	153
10 1900-Along Cross Result										18	S
										4	off
										18	147

KEY = All speeds in CM/SEC
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

TABLE 4: Current Data
FEB 1988

Alongshore Cross-shore Resultant Time Day	Pier Measurements						Beach Measurements (500m Updrift)			Current Meter at South Tripod	
	Dye at (579 m) (surface) Speed	Dye at (579 m) (surface) Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Depth -4.8m (NGVD) ID #679	Speed	Dir
11 0100-Along Cross Result										16	S
										3	off
										16	149
11 0700-Along Cross Result	32	S				41	S		North	20	S
	10	on	152			2	off			4	off
	33	177				41	157			20	149
11 1300-Along Cross Result										20	S
										3	off
										20	151
11 1900-Along Cross Result										13	S
										0	
										13	160
12 0100-Along Cross Result										8	S
										1	off
										8	153
12 0700-Along Cross Result	0		152	76	N		9	S		11	S
	0			0						4	off
	0	0		76	340					12	140
12 1300-Along Cross Result										7	S
										1	on
										7	168
12 1900-Along Cross Result										13	S
										8	off
										15	128
13 0100-Along Cross Result										20	S
										0	
										20	160
13 0700-Along Cross Result	25	S				29	S		North	26	S
	19	off	140			15	off			1	off
	32	123				32	133			16	156
13 1300-Along Cross Result										6	S
										1	on
										6	169
13 1900-Along Cross Result										2	S
										1	on
										2	187
14 0100-Along Cross Result										14	N
										4	on
										15	324
14 0700-Along Cross Result	2	S		20	S		26	S		10	N
	2	off	152	3	off					1	on
	3	112		21	151					10	334
14 1300-Along Cross Result										13	N
										0	
										13	340
14 1900-Along Cross Result										9	N
										3	on
										9	322
15 0100-Along Cross Result										12	N
										5	on
										13	317
15 0700-Along Cross Result	36	N		32	N		15	N		8	N
	2	off	140	0						3	on
	36	343		32	340					9	319
15 1300-Along Cross Result										28	N
										3	on
										28	334
15 1900-Along Cross Result										8	N
										3	on
										9	319

KEY = All speeds in CM/SEC
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

TABLE 4: Current Data
FEB 1988

Day	Pier Measurements				Beach Measurements				Current Meter at South Tripod		
	Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface)		(500m Updrift)		Dye 12m offshore (surface)		Depth -4.8m (NGVD)	ID #679	
Alongshore Cross-shore Resultant	Time	Speed	Dir	Distance from Baseline (m)	Speed	Dir	Location	Speed	Dir	Speed	Dir
16 0100-Along Cross Result										10	N
16 0700-Along Cross Result	47	S			34	N				3	on
	7	off		152	2	off	South	56	S	10	323
	47	151			34	343				8	
										1	on
										8	333
16 1300-Along Cross Result										20	S
16 1900-Along Cross Result										4	off
										20	149
17 0100-Along Cross Result										12	S
17 0700-Along Cross Result	7	N			19	N				3	off
	9	off		140	3	off	South	30	S	12	146
	12	30			19	349				2	S
17 1300-Along Cross Result										5	off
17 1900-Along Cross Result										5	92
18 0100-Along Cross Result										4	N
18 0700-Along Cross Result	11	N			6	N				1	on
	3	off		140	2	off	South	11	S	4	326
	12	357			6	2				1	N
18 1300-Along Cross Result										1	off
18 1900-Along Cross Result										1	25
19 0100-Along Cross Result										1	N
19 0700-Along Cross Result	0				24	N				3	on
	9	on		152	7	on	South	18	S	3	268
	9	250			25	323				11	
19 1300-Along Cross Result										8	off
19 1900-Along Cross Result										14	124
20 0100-Along Cross Result										10	S
20 0700-Along Cross Result	5	N			32	N				4	off
	6	on		152	8	off	North	89	S	11	138
	7	290			33	354				3	
20 1300-Along Cross Result										8	S
20 1900-Along Cross Result										1	off
										8	153
										5	N
										2	on
										5	318

KEY = All speeds in CM/SEC
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

TABLE 4: Current Data
FEB 1988

Day	Alongshore Cross-shore Resultant Time	Pier Measurements						Beach Measurements (500m Updrift)			Current Meter at South Tripod Depth -4.8m (NGVD) ID #679		
		Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	Speed
21	0100-Along Cross Result										2	S	
21	0700-Along Cross Result	4	S				5	S			3	on	
		7	off		152		3	off		North	4	216	
		8	97				6	129			7	313	
21	1300-Along Cross Result										18	S	
											4	off	
											18	147	
21	1900-Along Cross Result										20	S	
											9	off	
											22	136	
22	0100-Along Cross Result										11	S	
											6	off	
											13	131	
22	0700-Along Cross Result	32	N				55	N			8	N	
		0			152		0			South	3	on	
		32	340				55	340			9	319	
22	1300-Along Cross Result										7	N	
											5	on	
											9	304	
22	1900-Along Cross Result										15	N	
											5	on	
											16	322	
23	0100-Along Cross Result										11	N	
											5	on	
											12	316	
23	0700-Along Cross Result	34	N				41	N			15	N	
		8	off		140		4	off		South	2	on	
		35	354				41	346			15	332	
23	1300-Along Cross Result										15	N	
											2	on	
											15	332	
23	1900-Along Cross Result										10	N	
											4	on	
											11	318	
24	0100-Along Cross Result										3	N	
											1	off	
											3	358	
24	0700-Along Cross Result	20	S				15	N			4	S	
		6	off		152		2	off		South	0		
		21	143				15	349			4	160	
24	1300-Along Cross Result										10	S	
											3	off	
											10	143	
24	1900-Along Cross Result										13	S	
											3	off	
											13	147	
25	0100-Along Cross Result										8	S	
											1	off	
											8	153	
25	0700-Along Cross Result	55	S				12	S			17	S	
		0			177		5			North	2	off	
		55	160				13	138			17	153	
25	1300-Along Cross Result										17	S	
											10	off	
											20	130	
25	1900-Along Cross Result										12	S	
											5	off	
											13	137	

KEY = All speeds in CM/SEC
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

TABLE 4: Current Data
FEB 1988

Alongshore Cross-shore Resultant Time	Pier Measurements						Beach Measurements (500m Updrift)			Current Meter at South Tripod	
	Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface)		Dye 12m offshore (surface)		Location	Speed	Dir	Depth -4.8m (NGVD)	ID #679
Day	Speed	Dir	Distance from Baseline (m)	Speed	Dir				Speed	Dir	
26 0100-Along Cross Result									13	S	
26 0700-Along Cross Result	55 0	S off	152	41 12	S off		61 S	20 0	3 20	147 160	
26 1300-Along Cross Result	55	160		42	143				17 2 17	S on 167	
26 1900-Along Cross Result									11 0 11	S 160	
27 0100-Along Cross Result									1 2 2	N on 277	
27 0700-Along Cross Result	14 21 25	N off 36	152	25 4 26	S off 151		5 S	6 5 8	6 5 300	N on 300	
27 1300-Along Cross Result									4 3 5	N on 303	
27 1900-Along Cross Result									12 7 14	S off 130	
28 0100-Along Cross Result									36 4 36	S off 154	
28 0700-Along Cross Result	102 0	S off	152	122 0	S		124 S	53 10 54	S off 149		
28 1300-Along Cross Result	102	160		122	160				52 9 53	S off 150	
28 1900-Along Cross Result									25 2 25	S off 155	
29 0100-Along Cross Result									3 1 3	S off 142	
29 0700-Along Cross Result	17 3 17	N off 349	152	76 4 76	N off 343		46 N	3 1 3	N off 358		
29 1300-Along Cross Result									25 2 25	N off 345	
29 1900-Along Cross Result									6 2 6	N on 322	

KEY = All speeds in CM/SEC
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

PART V: SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) taken at the seaward end of the pier are made of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves but not surface chop or capillary waves). The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring the alignment of the wave crests. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 deg east of true north; consequently, wave angles greater than 70 deg indicate that the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are made daily at the seaward end of the FRF pier. A jar along with a thermometer is lowered about 0.3 m into the water and allowed to remain for at least one minute. The jar is removed, the temperature read, and a hydrometer is used to determine the density. A Secchi disc is used to determine the surface visibility.

Table 5: Supplemental Observations

FEB 1988

Day	Time	Wave Approach Angle at Pier End deg from True N		Radar Wave Angle deg from True N	Width of Surf Zone,m	Water Characteristics at Pier End		
		Primary	Secondary			Temp.,C	Density g/cc	Secchi Vis.,m
1	0720	110			32	6.2	1.0247	1.8
2	0700	90			52	7.5	1.0250	2.4
3	0850	40		50	180	7.2	1.0250	0.3
4	0745	90	50		87	7.2	1.0248	0.6
5	0750	40			96	5.3	1.0222	2.1
6	0740	10		40	64	4.5	1.0235	1.5
7	0735	60		40	61	2.8	1.0231	2.4
8	0745	100			52	3.4	1.0230	2.4
9	0737	40		70	98	5.0	1.0238	2.1
10	0735	90	40		76	5.0	1.0237	2.4
11	0800	70		90	169	5.0	1.0210	1.5
12	0745	100			258	5.6	1.0224	0.3
13	1020	70	10	65	58	4.0	1.0226	0.6
14	0920	70	30		75	3.9	1.0228	2.7
15	0920	none visible			55	5.9	1.0237	3.0
16	0800	none visible		100	79	5.6	1.0248	1.2
17	0730	40	90		56	5.6	1.0248	2.1
18	0745	100	40		9	6.0	1.0246	3.0
19	0800	90		50	59	6.7	1.0246	1.5
20	0646	90			49	6.7	1.0244	3.0
21	0630	95	0		7	5.9	1.0244	3.0
22	0740	50			47	5.6	1.0232	3.4
23	0730	none visible			52	6.1	1.0243	3.0
24	0800	none visible			52	6.4	1.0238	6.4
25	0820	30			61	6.1	1.0225	4.0
26	0816	40		60	85	5.6	1.0210	3.0
27	0630	80			7	5.8	1.0240	2.4
28	0655	20		70	195	5.6	1.0260	0.9
29	0815	60	90		257	5.6	1.0234	1.2

PART VI: WATER LEVELS

The National Ocean Services (NOS) has established a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect data every 6 minutes throughout the month.

Figure 4 shows the variation in mean water levels computed over a tidal cycle period (12.42 hours) and contains a list of selected mean and extreme values. This presentation is useful in identifying effects of both meteorological and astronomical forces on the open coast water levels.

Table 6 contains the time of the center of each sampling interval and the range, high, low, and mean water levels during each tidal cycle.

FRF TIDE HEIGHTS

FEB 1988

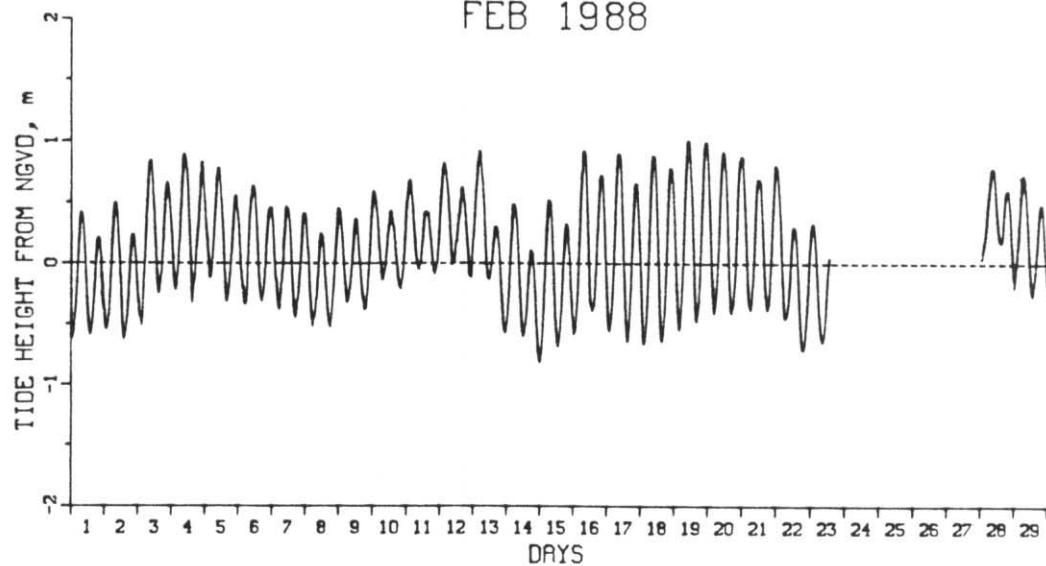


Figure 4. Time history of mean water levels

MONTHLY WATER LEVELS (METERS NGVD)

EXTREME LOW	=	-0.82 ON DAY 14 AT 2242 HR
EXTREME HIGH	=	1.00 ON DAY 19 AT 824 HR
MONTHLY MEAN	=	0.09
MEAN LOW	=	-0.43
MEAN HIGH	=	0.58
MEAN RANGE	=	1.02

Table 6: WATER LEVELS, METERS NGVD *

FEB 1988					
MID-CYCLE	LOW	HIGH	MEAN	RANGE	
DAY TIME					
1 612	-0.62	0.42	-0.12	1.04	
1 1837	-0.59	0.21	-0.22	0.80	
2 703	-0.63	0.49	-0.03	1.12	
2 1928	-0.62	0.23	-0.18	0.86	
3 753	-0.51	0.84	0.27	1.35	
3 2018	-0.23	0.66	0.20	0.89	
4 843	-0.33	0.89	0.34	1.21	
4 2109	-0.17	0.83	0.30	0.99	
5 934	-0.32	0.78	0.27	1.10	
5 2159	-0.34	0.55	0.10	0.89	
6 1024	-0.34	0.63	0.16	0.97	
6 2249	-0.38	0.46	0.06	0.84	
7 1115	-0.45	0.46	0.02	0.91	
7 2340	-0.52	0.41	-0.03	0.93	
8 1205	-0.53	0.25	-0.16	0.77	
9 30	-0.36	0.45	0.03	0.81	
9 1255	-0.38	0.37	-0.03	0.75	
10 121	-0.26	0.59	0.19	0.86	
10 1346	-0.21	0.43	0.10	0.64	
11 211	-0.12	0.68	0.29	0.80	
11 1436	-0.09	0.42	0.18	0.52	
12 301	-0.02	0.81	0.42	0.83	
12 1527	-0.12	0.62	0.27	0.74	
13 352	-0.13	0.91	0.44	1.04	
13 1617	-0.58	0.30	-0.07	0.88	
14 442	-0.61	0.48	-0.02	1.09	
14 1707	-0.82	0.11	-0.33	0.93	
15 532	-0.79	0.52	-0.08	1.31	
15 1758	-0.69	0.33	-0.19	1.01	
16 623	-0.57	0.92	0.21	1.48	
16 1848	-0.56	0.72	0.10	1.28	
17 713	-0.64	0.90	0.18	1.53	
17 1938	-0.67	0.66	-0.01	1.32	
18 804	-0.65	0.88	0.14	1.53	
18 2029	-0.64	0.78	0.11	1.43	
19 854	-0.55	1.00	0.25	1.55	
19 2119	-0.46	0.99	0.29	1.45	
20 944	-0.41	0.91	0.26	1.33	
20 2210	-0.37	0.88	0.27	1.25	
21 1035	-0.38	0.69	0.15	1.08	
21 2300	-0.45	0.80	0.20	1.26	
22 1125	-0.72	0.30	-0.17	1.02	
22 2350	-0.71	0.33	-0.16	1.05	
23 1216					
24 41					
24 1306					
25 131			Gage		
25 1356			Inoperative		
26 222					
26 1447					
27 312					
27 1537					
28 402					
28 1628	-0.14	0.60	0.31	0.75	
29 453	-0.22	0.73	0.28	0.94	
29 1718	-0.27	0.48	0.09	0.75	

* All water level data for February
are questionable because of a
partially clogged well orifice.

PART VII: NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in January and the two surveys in February on profile line 188, located 517 m south of the pier. The first survey in February shows significant accretion on the foreshore (60 to 140 m) accompanied by a 50-m seaward migration of the nearshore bar (140 to 280 m). The last survey shows the foreshore continuing to accrete while the nearshore bar remains stationary. Only minor changes are visible on the remainder of the profile.

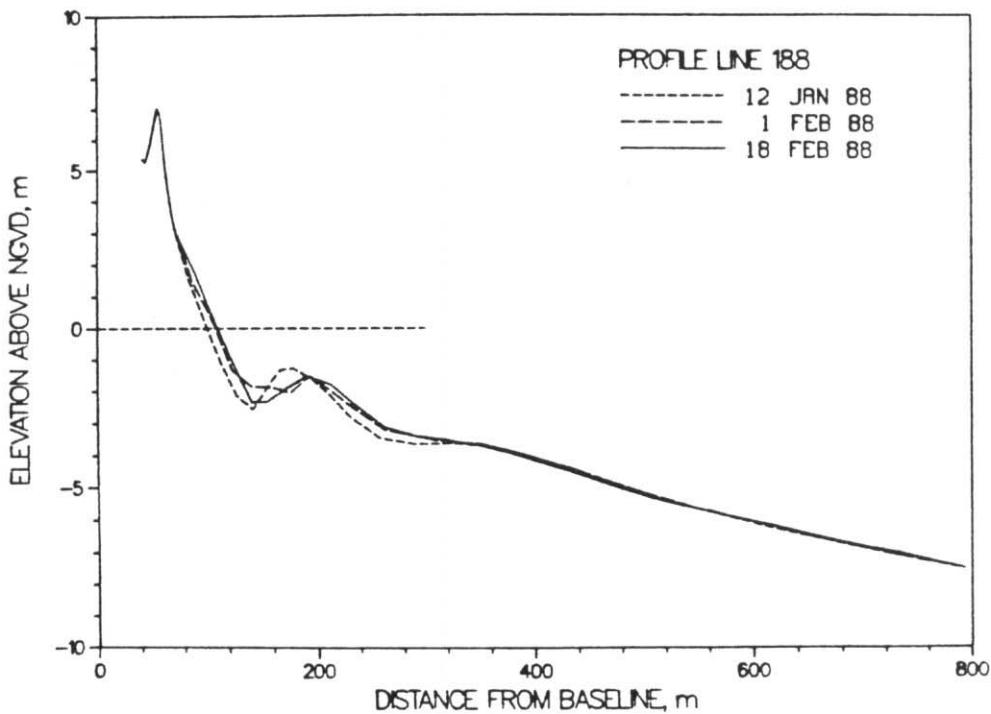


Figure 5. Monthly CRAB profiles on profile 188 - 517 m south of pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile during 1988. The only significant change (160 m) represents the seaward migration of the nearshore bar.

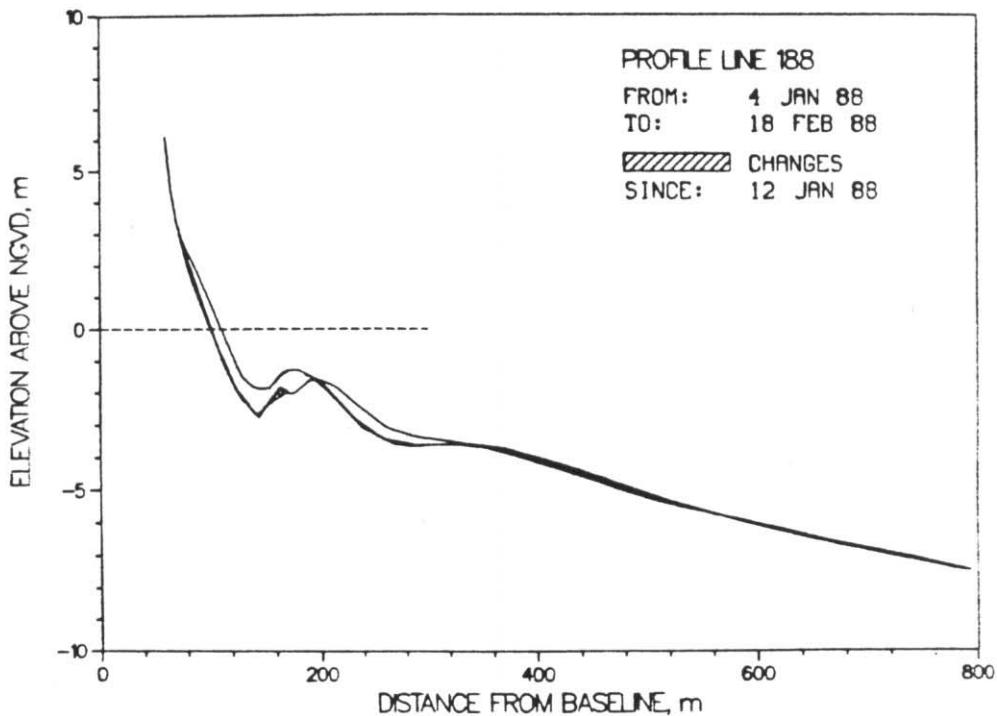


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 includes a two- and three-dimensional contour map and a change plot derived from the bathymetric survey conducted on 2 February. Wide contour lines on the change diagram represent areas which eroded; thin lines indicate accretion.

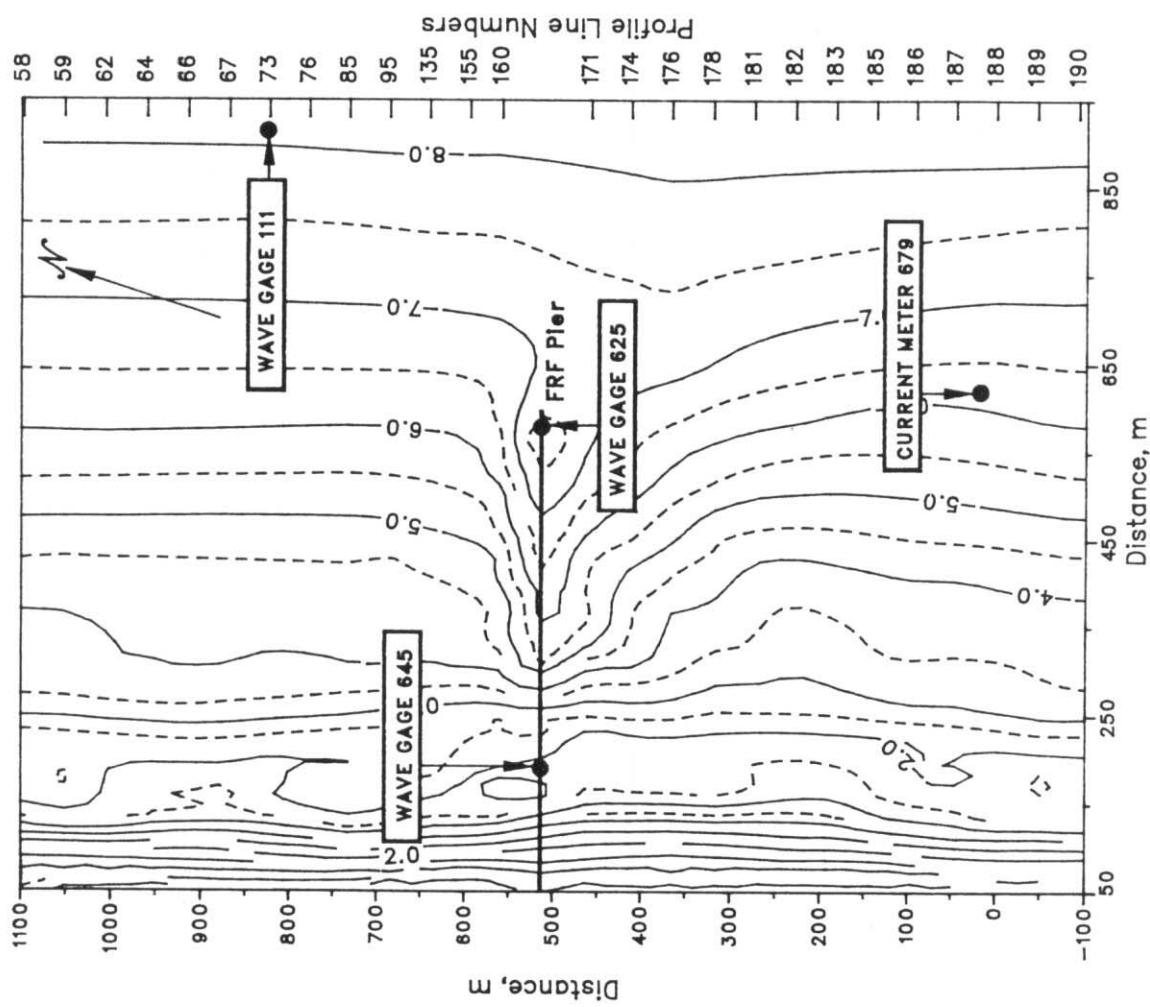
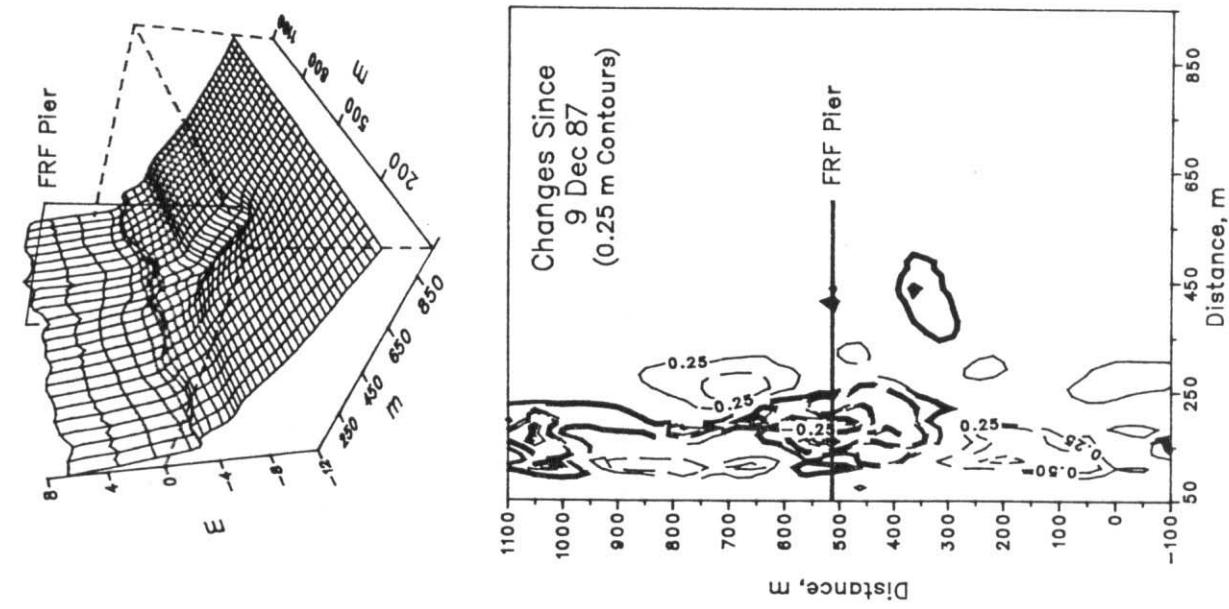


FIGURE 7. FRF BATHYMETRY 2 Feb 88
(Depths Relative to NGVD)

PART VIII: SPECIAL EVENTS

A. Storm Data Collection. The following list identifies times when the wave height at the seaward end of the pier (i.e. as measured by Gage 625 at pier station 19+00) exceeded 2 m. When this occurred, four contiguous 34-min wave records were obtained every three hours:

<u>Start</u>	<u>End</u>
12 Feb (0100)	12 Feb (0808)
28 Feb (0508)	29 Feb (0542)

B. Storm Synopsis.

12 February - This storm formed over Texas early on 10 February and rapidly intensified as it moved to the north-northeast. By 12 February, it was located over Lake Erie and two weak secondary lows formed in the Atlantic (one off Cape Hatteras, NC). All three lows merged over New England by 13 February. Maximum onshore winds (from east-northeast) approached 7 m/s at 0134 hr on 12 February followed several hours later by the maximum H_{mo} of 2.25 m ($T_p = 9.14$ sec). Minimum barometric pressure was 1006.8 mb and precipitation totaled 25 mm.

28 February - Generically known as an "Alberta Clipper," this storm roared out of Canada on 26 February and was located off Cape Hatteras, NC by 28 February. Northerly winds exceeded 16 m/s early on the 28th with the maximum H_{mo} of 2.76 m ($T_p = 8.00$ sec) recorded the same morning. The minimum barometric pressure of 1004.4 mb occurred at 1442 hr on 27 February. There was no measurable precipitation with this storm.

Distribution List

Government Agencies:

OCE
BERH
NAO
NASA/Wallops Flight Center
NOAA (NOS, NWS)
SAD
SAW

U.S. Geological Survey
U.S. National Park Service
U.S. Naval Academy
U.S. Naval Civil Eng. Lab
U.S. Naval Fac. Eng. Com.
U.S. Naval Oceanographic Off.
U.S. Naval Research Lab

Colleges/Universities:

California Inst. of Tech.
East Carolina University
Florida Inst. of Tech.
Harvard University
Naval Post Graduate School
NC State University
Old Dominion University
Oregon State University
Prince George's College
Rutgers University
Scripps Inst. of Oceanography
Southern Illinois University

Stockton State College
University of Akron
University of Delaware
University of Florida
University of Maryland
University of Miami
University of North Carolina
University of N. Colorado
University of Rhode Island
University of Virginia
Va. Inst. of Marine Science

Others:

City of Va. Beach, VA
Coastal Barge Corporation
Coastal and Est. Res., Inc.
Coastal Science & Eng., Inc.
Dr. Galvin
GEOMET Tech., Inc.
Greenhorne & O'Mara, Inc.
Dr. Hylton
Mary Marr, Inc.
Masonite Corporation

MEC Systems Corporation
Moffatt & Nichol, Eng.
Offshore Coastal Technologies
Mr. Rowland
Mr. Savage
Sea Port Supply Corp.
Shell Development
Sherwood Industries
Mr. & Mrs. Valpey
WCTI-TV

Foreign:

W. F. Baird & Asso. Coastal Engineers, Ltd (Canada)
Queen's University, Ontario (Canada)
Ministry of Construction, Coastal Division (Japan)
Norwegian Hydrodynamic Laboratories (Norway)
University of New South Wales (Australia)
University of Sydney (Australia)